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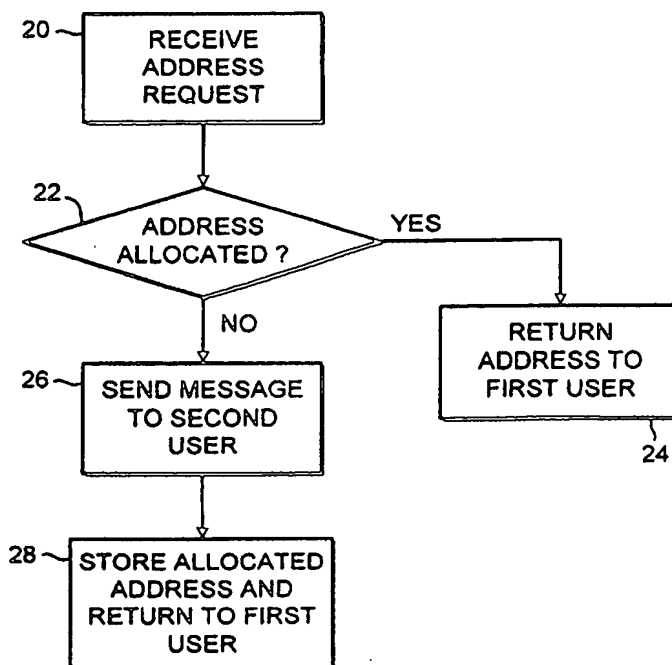
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(21) International Application Number: PCT/EP99/00253 (22) International Filing Date: 18 January 1999 (18.01.99) (30) Priority Data: 9801064.8 19 January 1998 (19.01.98) GB (71) Applicant: TELEFONAKTIEBOLAGET LM ERICSSON [SE/SE]; S-126 25 Stockholm (SE). (72) Inventor: WIRKESTRAND, Anders; Hålsingegatan 13, S-113 23 Stockholm (SE). (74) Agent: O'CONNELL, David, Christopher; Haseltine Lake & Co., Imperial House, 15-19 Kingsway, London WC2B 6UD (GB).		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>

(54) Title: METHOD FOR ALLOCATING IP ADDRESSES TO HOST DESTINATION TERMINALS ON THE INTERNET ON REQUEST BY A SOURCE TERMINAL

(57) Abstract

In a computer network such as the internet, computers are able to remain permanently connected to the network, without requiring addresses to be permanently allocated thereto. When a computer wishes to communicate with another computer, which has no address allocated thereto at that time, as determined by a server such as a domain name server, a message is sent to that computer, requiring it to request an address, for example using the dynamic host configuration protocol.



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METHOD FOR ALLOCATING IP ADDRESSES TO HOST DESTINATION TERMINALS ON THE INTERNET ON REQUEST BY A SOURCE TERMINAL

TECHNICAL FIELD OF THE INVENTION

5 This invention relates to network operations, and in particular to the allocation of addresses in networks such as the internet.

BACKGROUND OF THE INVENTION

10 In order to be able to make a connection to an entity over a network, for example a computer network such as the internet, that entity must have an address allocated thereto. However, in some networks, the number of available addresses is smaller than the number which could be required.

15 To alleviate this problem, recognising the fact that many network users will only want to be connected to a network for a relatively small proportion of the time, internet addresses are typically allocated to a user temporarily. Such addresses can then be
20 reallocated when a connection is terminated and, when the user wishes to reconnect, he will again receive an address, which is unlikely to be the same as before. In one variation of this widely used principle, WO96/39770 describes an address management system in which a user at a remote access device receives a
25 username, and an internet protocol (IP) address. When the user disconnects, he loses the IP address, but, when he reconnects, he receives the same IP address as before.

30 However, this cannot solve difficulties caused by an excessively large number of users requiring permanent network connections, and hence permanently occupying network addresses. For the user, it may be advantageous to have a permanent connection, since this allows the user to be contacted by other entities, and
35 also allows the user to resume activity, after a pause,

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without going through a lengthy dial-up process. In a network such as the internet, the number of available network addresses is insufficient to allow every user to occupy a network address permanently, particularly in view of the expected growth in the numbers of internet users.

SUMMARY OF THE INVENTION

In accordance with aspects of the invention, some of the problems caused by the limited availability of network addresses can be overcome. Specifically, aspects of the invention allow a user to obtain some of the benefits of a permanent network connection, without requiring the user to occupy an address permanently.

Specifically, in one aspect of the invention, a user may be in an idle connected state. In this state, the entity does not have an allocated network address but, in the event that another entity wishes to contact the first, an address is allocated thereto.

More particularly, in one aspect of the invention, when an entity wishes to reach a user in an idle connected state, the user can be forced to request a network address which can be used for the connection.

In a further aspect of the invention, there is preferably provided a server which contains a database of network addresses allocated to network users, the server having the ability, when it determines that a particular user has no address allocated thereto, to force that user to obtain an address.

BRIEF DESCRIPTION OF DRAWINGS

Figure 1 is a schematic representation of a network embodying the invention.

Figure 2 is a flow chart illustrating a process carried out in a network access server in accordance with the invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

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Figure 1 represents a network operating in accordance with the invention. For example, the network may be applied to the internet as currently operating. A large number of hosts 2 are connected to a network access server 4. In accordance with the invention, each host may remain permanently connected to the relevant network access server, thus avoiding the need for the user to dial in to the network when resuming activity after a pause. Nevertheless, the host has no address allocated to it when at times when it is inactive.

Each network access server 4 serves a number of internet service providers, giving internet access to a large number of users. The network access server (NAS) 4 is thus connected to the internet service provider networks 6. Of course, the network includes many such network access servers. Each internet service provider network 6 is connected to a respective address allocation server, in the case of the internet known as a dynamic host configuration protocol (DHCP) server 8. Moreover each network access server has an address storage server, in the case of the internet known as a domain name system (DNS) server 10 associated therewith.

When a host wishes to initiate a network connection, it must obtain a network address. This is achieved using the dynamic host configuration protocol, and requests an address from the relevant DHCP server 8.

When a user wishes to contact a host which it knows only by its name and domain, it performs a Domain Name System request of its local domain name system server. The request takes the form of an indication of the known name and domain, and the DNS server contains a database of host names and their corresponding

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addresses. Thus, the user is then able to contact the desired host.

Of course, if the desired host is not connected to the network, the DNS server will report that no address is allocated, and the sending user would not conventionally be able to contact the host.

In accordance with the preferred embodiment of the invention, the functionality of the DNS server is extended so that, in the event that the desired host has no allocated address, the DNS server will be able to initiate the allocation of an address thereto, thereby allowing the sending user to contact the host.

Figure 2 is a flow chart illustrating the procedure in the DNS server. In step 20 of the procedure, the DNS server receives a request for a network address from a first ^{source} user, who wishes to contact a second ^{dest.} user, but only knows that user's domain name, but not the relevant internet protocol address.

As mentioned above, the DNS server contains a database of allocated addresses and, in step 22 of the procedure, it examines that database, to find the address of the second user.

If an address has been allocated, the procedure passes to step 24 and, in a conventional way, the address is returned to the first user, which is therefore able to contact the first user.

On the other hand, if the second user is in an idle connected state, and thus has no internet address allocated thereto (branch "NO" from step 22), the procedure passes to step 26, in which a message is sent to the second user. This message forces the second user to send a dynamic host configuration protocol (DHCP) request to the relevant DHCP server to check out a network address. The relevant message can

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advantageously be a layer 2 defined standard message. When this message is received at a communication port of a host, the host starts its DHCP client, which makes the request to the DHCP server.

5 The second host computer sends the DHCP request in a conventional way, and an address is allocated to it.

→ Also conventionally, this information is stored in the DNS server, which is then able to return the requested address to the first user, which is therefore able to

10 → contact the second user.

It is also necessary to provide a mechanism whereby a user can lose an address allocated thereto, in order to allow efficient usage of the available addresses. The network address server 4 can monitor the users and, if a user is idle (that is, sends no traffic) for, say 10 minutes, the address can be withdrawn from the user. Alternatively, the user can send a signal to the network address server, relinquishing the address.

20 There is thus provided a system which allows the user to remain permanently connected to the network, and thus able to be contacted at all times, while only requiring a network address to be allocated thereto for that (possibly rather small) fraction of the time for
25 which the address is required.

CLAIMS

1. A method of operation of a computer network, the network comprising:

5 a plurality of computers, each of which may have addresses allocated thereto to allow communications with other computers in the network, and

an address allocation server which allocates an address to a computer in response to a request therefrom,

10 the method comprising:

allowing computers to remain connected to the network without having an address allocated thereto, and,

15 to allow a first computer to communicate with a second computer which has no address allocated thereto, sending a message to the second computer, requiring it to send an address allocation request to the address allocation server.

2. A method as claimed in claim 1, wherein the address allocation server is a DHCP server.

20 3. A method as claimed in claim 1, in a network comprising at least one address storage server which comprises a database of addresses allocated to users and which informs users of addresses allocated to other users in response to address information requests, the method comprising:

25 determining in response to an address information request from the first computer that the second computer has no address allocated thereto, and sending the message to the second computer from the address storage server.

30 4. A method as claimed in claim 3, wherein the address storage server is a DNS server.

5. A computer network, comprising:
35 a plurality of computers, each of which may have

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addresses allocated thereto to allow communications with other computers in the network,

an address allocation server which allocates an address to a computer in response to a request therefrom, and

at least one address storage server which comprises a database of addresses allocated to users and which informs users of addresses allocated to other users in response to address information requests,

wherein, when the address storage server determines in response to an address information request from a first computer that a second computer has no address allocated thereto, it sends a message to the second computer requiring it to send an address allocation request to the address allocation server.

6. A network as claimed in claim 5, wherein the address allocation server is a DHCP server.

7. A network as claimed in claim 5, wherein the address storage server is a DNS server.

8. A method of operation of an address storage server including a database of addresses allocated to computers in a network, the method comprising:

examining the database in response to a request from a first computer to determine the network address of a second computer, and

if it is determined that the second computer has no address allocated thereto, sending a message to the second computer which requires it to request an address allocation.

9. A method as claimed in claim 8, further comprising subsequently returning the allocated address to the first computer.

10. An address storage server, for use in a computer network which requires computers to have addresses allocated thereto to allow communication with

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other computers in the network, the address storage server comprising a database of addresses allocated to users and informing users of addresses allocated to other users in response to address information

5 requests,

wherein, when the address storage server determines in response to an address information request from a first computer that a second computer has no address allocated thereto, it sends a message to the second computer requiring it to request an address allocation.

10

11. An address storage server as claimed in claim 10, in the form of a DNS server.

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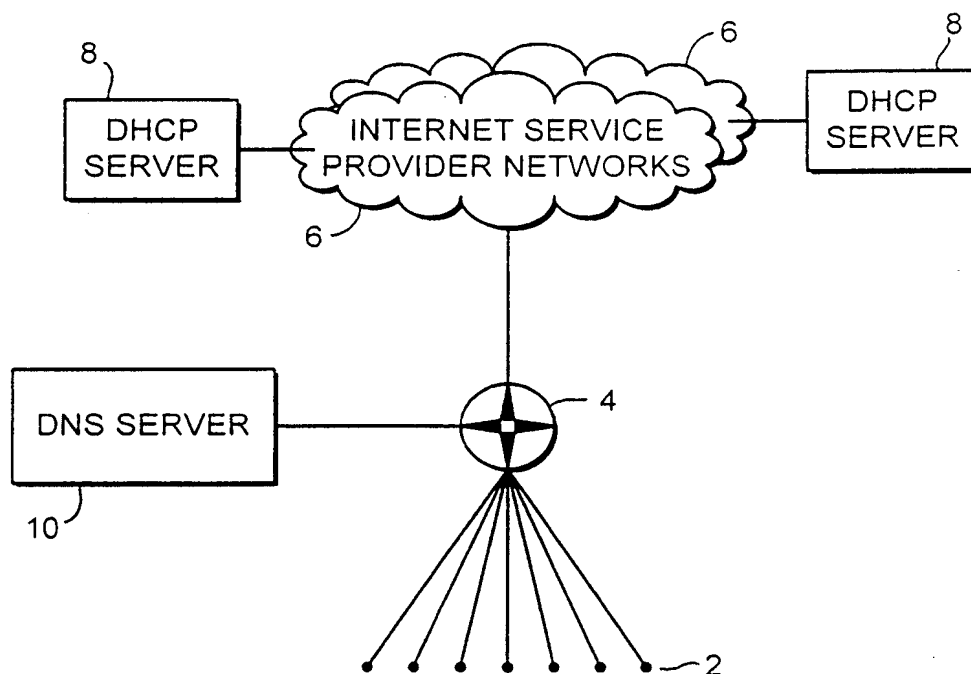


FIG. 1

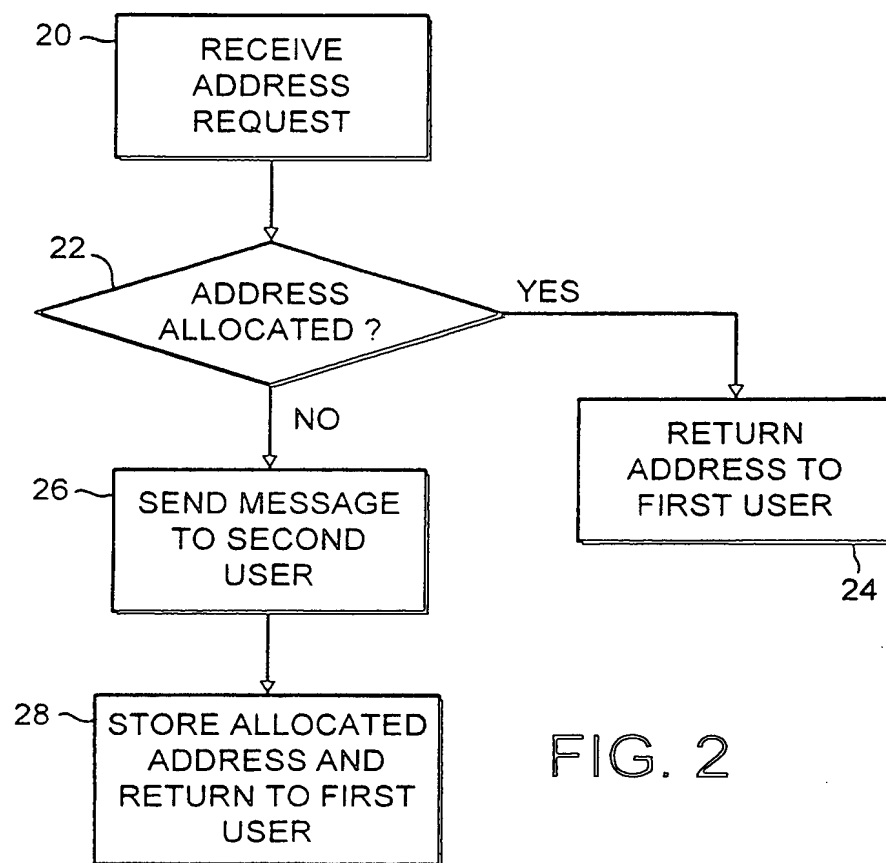


FIG. 2

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 99/00253

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04L29/12 H04L29/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 781 015 A (SONY CORP) 25 June 1997 see column 1, line 35 - column 2, line 11 see column 3, line 15 - line 55 see column 5, line 9 - column 6, line 48 see column 7, line 27 - column 8, line 22 see column 10, line 42 - column 11, line 10 ---	1-11
A	FOO S ET AL: "APPROACHES FOR RESOLVING DYNAMIC IP ADDRESSING" INTERNET RESEARCH: ELECTRONIC NETWORKING APPLICATIONS AND POLICY, vol. 7, no. 3, 1 January 1997, pages 208-216. XP000199862 see the whole document --- -/--	1-11

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

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European Patent Office, P.B. 5818 Patentlaan 2
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Carnerero Álvaro, F

INTERNATIONAL SEARCH REPORT

International Application No

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 96 39770 A (SHIVA CORP) 12 December 1996 cited in the application see abstract ---	1,3,5,8, 10
A	EP 0 691 772 A (FUJITSU LTD) 10 January 1996 see abstract see page 3, line 41 - page 4, line 20 see page 5, line 44 - line 52 see page 8, line 42 - line 47 see page 12, line 57 - page 13, line 9 see page 13, line 37 - page 14, line 9 see figures 1,2,10,19 -----	1,3,5, 8-10

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP 99/00253

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
EP 0781015	A	25-06-1997	JP 9168033	A	24-06-1997
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			AU 5533596	A	24-12-1996
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			US 5774662	A	30-06-1998

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